



Valves for Refining Applications

Engineered Solutions for the Refining Industry

MOGAS[®]

***MOGAS severe service ball valves have proven successful
in these processes and more:***

Atmospheric Distillation

Vacuum Distillation

Continuous Catalytic Reforming (CCR)

Visbreaking

Fluidized Catalytic Cracking (FCC)

Fixed Bed Hydrotreating

Fixed Bed Hydrocracking

Ebullated Bed Hydrocracking

Delayed Coking

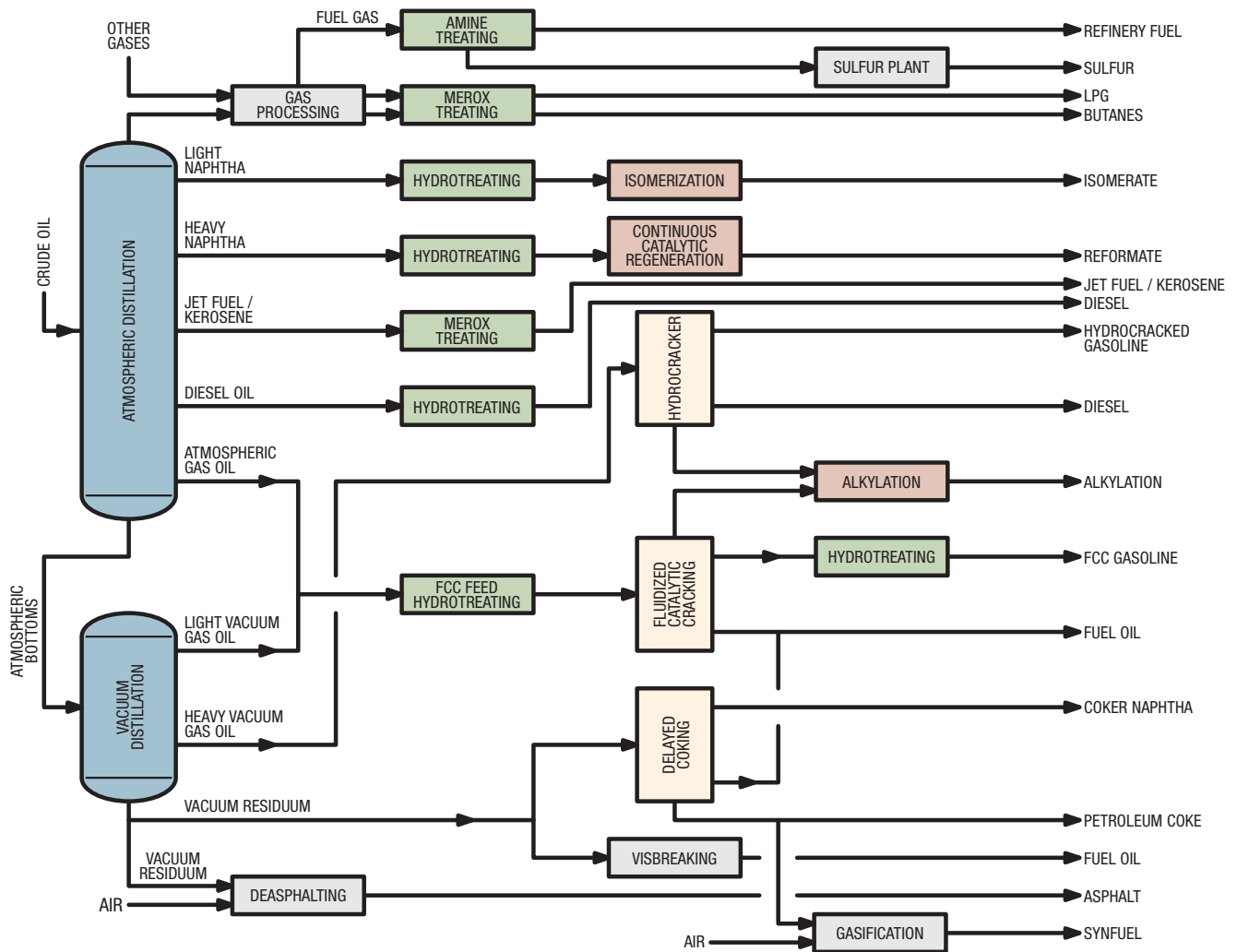
Gasification

Deasphalting

MOGAS — Your Partner in the Process

Proven Reliability. Engineering Expertise. Dependable Service.



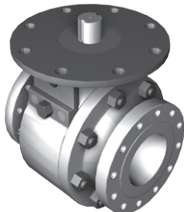


The refining industry has undergone many changes, from the methods of processing to the length of time that they operate their process units. These changes, along with the emergence of low sulfur fuel specifications, the requirement to process lower grade crude and the need to convert more bottom-of-the-barrel residuals, has put an extreme demand on isolation and control valves. Unreliable and unpredictable valves in emergency situations can cause enormous monetary losses and have devastating consequences for personnel. MOGAS has responded to these challenges by developing a combination of diverse trim configurations and high quality coatings for use in high temperature, high pressure, erosive, corrosive, viscous and coking / asphaltene applications.



Valves for Refining Applications

Severe plant conditions can quickly turn into severe consequences for your business. That's why companies worldwide turn to MOGAS Industries — the leading provider of severe service ball valves. Combining over four decades of experience with the most advanced manufacturing practices available, MOGAS helps ensure process integrity, uptime reliability and personnel safety. The result — immediate business efficiencies and lower total cost of ownership in the long term. In short, MOGAS valves perform in the harshest environments so your company can too.



Valves for Refining Applications					
	Key Features	Size (in)	Pressure Class	Body Materials	Maximum Temperature
	ISOLATOR 2.0 Low Pressure Isolation Valves <ul style="list-style-type: none"> • full bore • 2-piece forged body • bi-directional • blowout-proof stem 	1 to 4	150 to 600	F316, F9, F53, A105, Ti Gr 12	Ambient to 650° F (to 343° C)
	CA-H01 Heavy Oil Valves <ul style="list-style-type: none"> • engineered specifically for heavy oil applications • 2-piece forged body • blowout-proof stem 	1 to 3	900 to 4500	300 Series, Carbon Steel, Chrome Molybdenum	651 to 1100° F (343 to 593° C)
	C-Series Customizable Isolation Valves <ul style="list-style-type: none"> • engineered specifically for customer application • 2-piece or 3-piece forged body • blowout-proof stem 	4 to 36	300 to 4500	300 Series, Carbon Steel, Chrome Molybdenum	651 to 1500° F (343 to 815° C)
	RSVP / iRSVP Vent and Drain Valves <ul style="list-style-type: none"> • integrated vented body • quarter-turn, non-rising stem • rigid mounting bracket 	1/2 to 4	300 to 4500	F22, A105, F91	Ambient to 1100° F (to 593° C)
	FlexStream Control Technology <ul style="list-style-type: none"> • velocity control • variable characterization • high rangeability • precision modulation 	1 to 42	300 to 4500	300 Series, Carbon Steel, Chrome Molybdenum	Ambient to 1100° F (to 593° C)

Design Flexibility

C-Series Valve Adapts to Applications

Common Features for the MOGAS C-Series Valve Line

1 Floating ball design

- Rotating ball does not displace volume or solids
- Straight-through bore path protects sealing surfaces

2 Pressure-energized sealing

- Seat springs maintain constant sealing contact between ball and seats
- Allows for thermal expansion of trim
- Metal seats wipe sealing surface of ball clean during operation

3 Wide seat sealing surface

- Matched ball and seat sets provide total sealing contact for reliable isolation
- Greater sealing contact area withstands minor scratches or abrasions

4 Independent replaceable seats

- Minimizes maintenance and repair costs

5 Blowout-proof stem design

- One piece design meets industry safety standards
- Withstands severe service torques and maximum working pressures

6 Dual-guided stem design

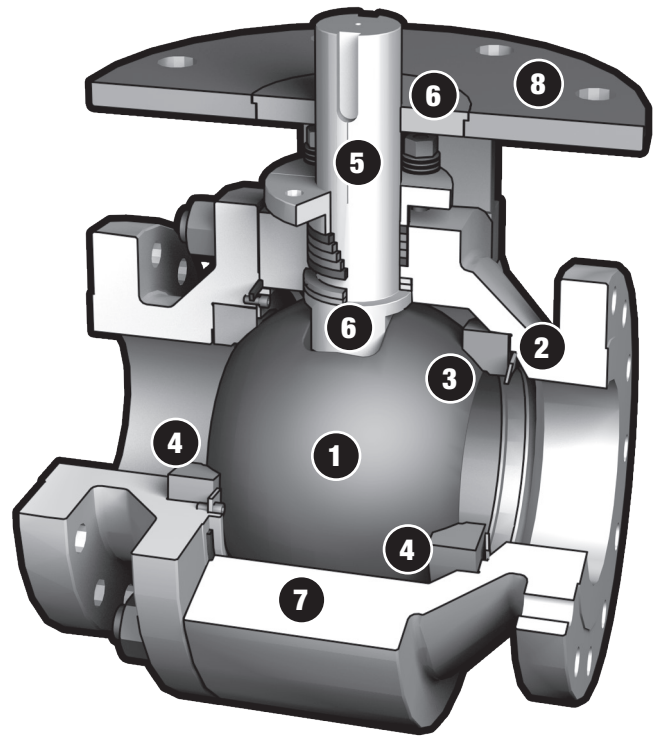
- Pressure-energized inner stem seals serve as thrust bearing and lower stem guide
- Valve stem bushing serves as upper stem guide
- Eliminates lateral movement of valve stem
- Prevents media migration
- Prevents stem packing leaks and risk of fugitive emissions

7 Forged body & end connections

- Greater wall thickness in critical areas provides longer valve life
- 2 or 3-piece designs

8 Heavy-duty mounting flange

- Machined after attaching to ensure precise stem alignment
- Provides structural support for operator mounting
- Provides visual inspection for confirmation of ball position



Application Specific Options

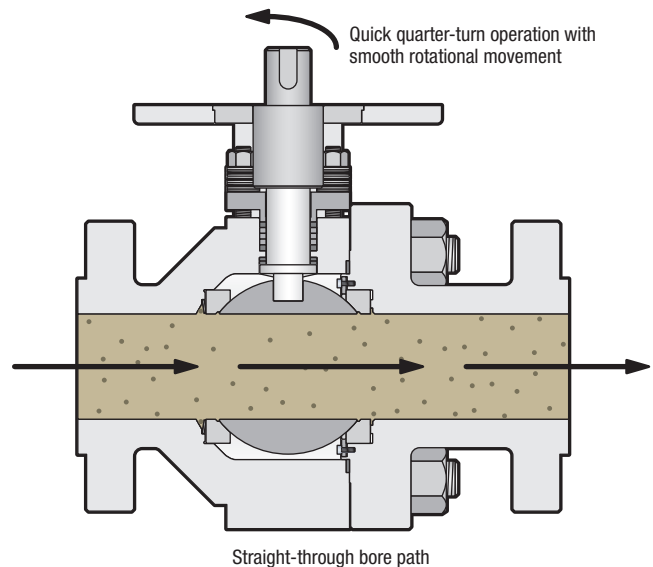
Seat designs	Engineered for maximum performance in application-specific conditions
Live-loaded packing	Ensures constant packing energization Prevents stem packing leaks and risk of fugitive emissions
Body Gaskets	Pressure energized body gasket available to meet industry codes
Materials	Application-specific materials available, including exotics Extends valve life
Coatings	Application-specific coatings provide enhanced erosion and corrosion resistance
Liners and inlays	Liners and inlays can be applied to the through-bore or wetted surfaces
Purge ports	Purge ports are available for recommended periodic maintenance
End connections	Available end connections include flanged, welded, hub/clamp or RTJ

Ball Valve Advantages

Compared to Gate and Globe Valves

When it comes to valve types, there are distinctive differences in design, intent and purpose. Whether a valve has rotary operation or linear action is a critical part of the **longevity** and **performance** of the valve in severe services. Exposed sealing mechanisms versus protected sealing surfaces can make a big difference. Commodity valves manufactured for clean environments at ambient or low temperatures are simply not engineered to withstand the strenuous demands of extreme operating conditions.

Serious industrial processes require serious valve choices. Understanding the fundamental differences in valve types can assist with those important decisions.



Ball Valve Advantages

Recessed seats are protected from continual exposure to the process flow

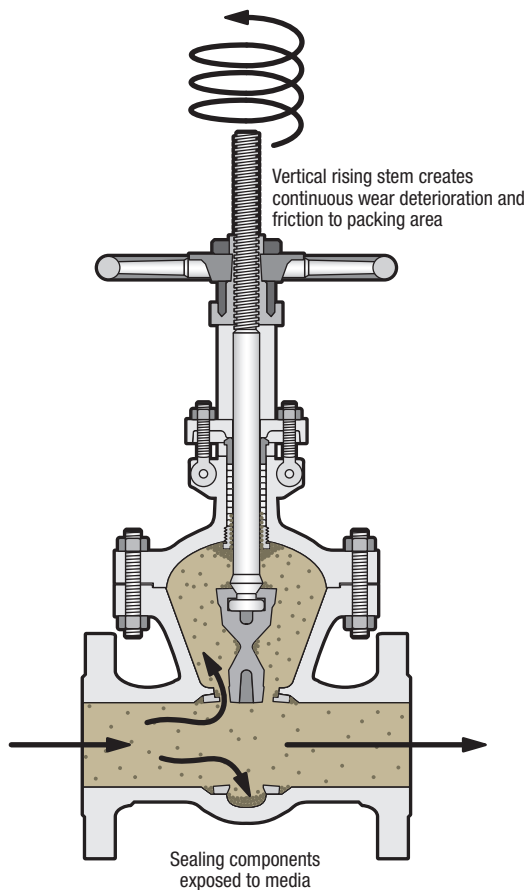
Ball is wiped clean with each operation of the valve

Rotates on own axis, thus no volumetric displacement

Packing area is protected from potential media erosion, maintaining integrity of stem seal area while reducing risk of fugitive emissions

Non-rising stem design meets EPA VOC packing leakage standards for greater number of cycles

Pressure-assisted sealing



Gate Valve Disadvantages

Sealing components in the line of flow lead to potential wear and corrosion attack

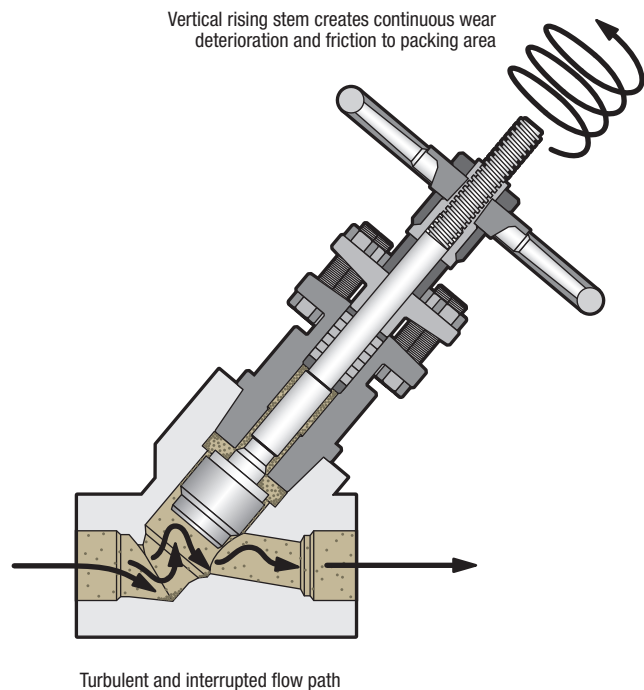
Geometry of the exposed sealing surface wears and loses the ability to hold tight seal

When operated, flow path is interrupted causing volumetric displacement of the process fluid which must occur from behind the plug back into the flowstream

Multi-turn rising stems can pull destructive catalyst and pipe scale up through the interior diameter of packing area leading to possible hazardous atmospheric leaks

A sliding stem valve will not provide the length of service life or number of cycles due to the stem moving through the packing box along with the process fluid

Relies on vertical thrust by the stem to drive the sealing plug into the seat



Globe Valve Disadvantages

Damage to sealing surfaces due to exposure of the seats when the valve is open

Sealing trough / rib erodes over time and can capture flow particles

When operated, flow path is interrupted causing volumetric displacement of the process fluid which must occur from behind the plug back into the flowstream

Multi-turn rising stems can pull destructive catalyst and pipe scale up through the interior diameter of packing area leading to possible hazardous atmospheric leaks

A sliding stem valve will not provide the length of service life or number of cycles due to the stem moving through the packing box along with the process fluid

Torque seated to activate seal — thermal cycling relaxes stem

Application Guide

Industry Expertise

Distillation — Atmospheric and Vacuum

In atmospheric distillation, the pipe still process takes the raw desalted crude and heats it up in the crude furnace until it is partially vaporized. This allows for the separation process to begin in the crude tower where several side streams are taken off at different boiling points.

In vacuum distillation the vacuum flasher provides a separation of atmospheric crude tower residue to produce heavy, medium and light vacuum gas oil and non-distillable products, such as vacuum residue.

A refinery fire is always a dangerous event, but a fire that reaches the large amounts of crude contained in the main tower and related side strippers can quickly go from dangerous to catastrophic.

As a leading provider of critical service valves, MOGAS has worked with several oil companies to create a reliable emergency bottoms isolation system. In a fire-related emergency, this system isolates the tower and strippers—and the highly flammable product they contain—from the source of the fire.

Continuous Catalytic Reforming (CCR)

The CCR process is primarily used in the refinery to improve the research octane number of the motor gasoline pool. It can also be configured for the production of aromatics for a petrochemical complex. A catalytic dehydrogenation reaction converts paraffins into iso-paraffins and naphthenes into aromatics. Hydrogen is a byproduct produced within this process and used in other parts of the refinery.

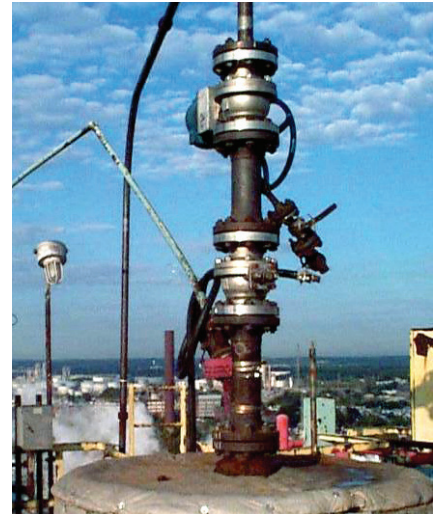
The leading licensor of this process has over 600 units installed globally, and has specified MOGAS isolation valves in its Schedule A specifications. This process package has evolved from a semi-regenerative to a continuous process, thus increasing the performance demands placed on the catalyst movement valves.

MOGAS has developed spray coatings that can cycle up to 50,000 times with no degradation in shutoff performance, which led to MOGAS being the preferred choice of the leading licensor of this process.

MOGAS has also developed a spring-loaded packing design to eliminate potential fires caused by hydrogen leakage within the process operating unit.

Visbreaking

The MOGAS C-Series valve, with its engineered trim configuration, gives 100 percent reliability during the visbreaking process, which reduces downtime significantly over gate designs. In applications where heavy coking occurs, MOGAS offers an intermittent and continuous purge system to remove the coke build-up.



Located at the top of a major refinery, these MOGAS valves were chosen for their performance and low maintenance. Due to their location, reliability was a critical part of the installation decision.



Installed between the lockhopper and lift engager at a major southwest refinery, these 3-inch ASME 300 class metal-seated isolation valves cycle at least three times an hour. These valves replaced another manufacturer's design that lasted only two months.

Application Guide

Industry Expertise

Fluidized Catalytic Cracking (FCC)

The FCC process is used for converting higher molecular weight hydrocarbons into value-added products. The conversion occurs in the presence of a catalyst that converts hydrotreated gas oils and fractionator bottoms into gasoline, C3 / C4 olefins and light cycle oils.

MOGAS has developed valve designs to handle the powdery ultra high temperature catalyst fines present during the removal process from the regenerator. In some cases the catalyst is carried over into the fractionator and is very erosive to gates and globe style valves. MOGAS' full-ported ball valves with special coatings have outperformed these designs lasting throughout the entire four- to five-year run times.

Fixed Bed Hydrotreating

High pressures and temperatures are required to break the sulfur and nitrogen molecular bonds that occur in residual, gas oil and diesel streams. In heavy metal crude processing refineries, a guard reactor system is typically put in place to prevent poisoning of the hydrotreating catalyst. The catalyst in the guard reactor has to frequently be removed due to collection of heavy metals on the catalyst.

Two licensors of fixed-bed hydrotreating process have developed unique methods of loading the guard reactors with fresh catalyst without taking the unit off-line. These guard reactor systems require catalyst withdraw and addition valves, which MOGAS can provide.

Fixed Bed Hydrocracking

The fixed bed hydrocracking process has the largest installed base of the two reactor types. The reactor will typically have multiple beds of catalyst. This catalyst cannot be removed as it is in the ebullated-bed process. Therefore, the run times are limited to approximately two years before catalyst performance is affected by coke build-up.

MOGAS has worked with several licensors of fixed-bed hydrocracking process technology to improve the performance of isolation applications in an attempt to make the overall process unit more reliable and safer to operate for the 600 to 700 operating process units throughout the world.

Ebullated Bed Hydrocracking

MOGAS valves operate in 100 percent of the ebullated bed hydrocracking units throughout the world, and has been working with the two ebullated bed hydrocracking technology licensors for over 20 years. MOGAS has been involved in the development of coatings and valve designs that can operate in arduous duty service conditions with 100 percent reliability for the entire projected four to five year run time.

This experience, performance record and continuous improvement has made MOGAS the preferred valve vendor for this process technology.



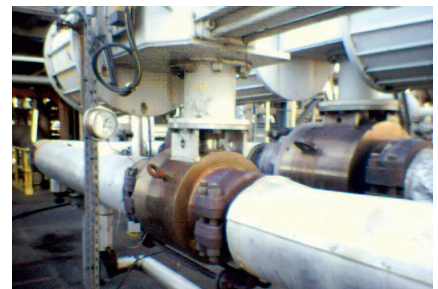
This CA-DRI 8-inch ASME 300 class valve handles catalyst at 1425° F (774° C). It is the major isolation valve between the third stage and fourth stage cyclone separator.



This CA-1AS 6-inch ASME 300 class feed isolation valve is a critical part of the emergency shutdown system.



Located in a frigid Scandinavian environment, this large bore ASME 4500 class ball valve is installed on the outlets of the hydrogen heater.



These 12- and 16-inch ASME 2500 class valves are installed at the letdown station of a European refinery responsible for producing 115,000 bpd.

Application Guide

Industry Expertise

Delayed Coking

Coking is a batch process that requires frequent operation of the isolation valve system during the coke drum switching operation.

MOGAS' simple floating ball design provides trouble-free operation in this heavy coking application, unlike complicated trunnion designs that provide several high tolerance areas for coke to build-up and cause torque to increase significantly from start of run to end of run of the unit.

Our floating ball design requires much less steam during purging operations than the typical trunnion designs, saving thousands of dollars annually in energy costs.

As a continuous improvement to the company's design, MOGAS has taken data from the field to determine the exact amount of service duty that should be applied to actuator and valve stem sizing. This helps avoid valve and actuator failure from increased torque due to coke build-up.

Gasification

MOGAS has worked with the leading licensor of the gasification process globally to develop trim and coating technology to increase the operational reliability of critical isolation valves.

MOGAS' most recent achievement was to extend the lockhopper valve system for de-slagging operations. This achievement improved performance from six months to five years with over 50,000 cycles of operation without any related valve or actuator failures.

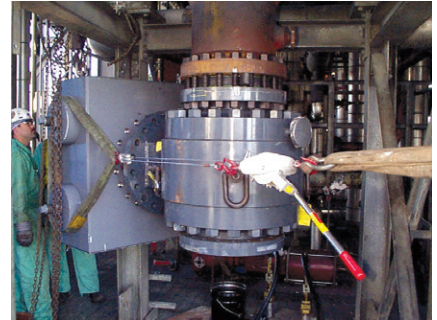
Deasphalting

Deasphalting is the process of removing asphalt, metals and sulphur from petroleum fractions. Removing asphaltenes prevents coke build-up on catalyst in downstream unit processing. It produces asphalt (asphaltenes, hard and soft resins) and deasphalted oil (DAO) as final products. This refining process can be considered a carbon rejection process, since asphaltenes that are removed have relatively low hydrogen-to-carbon (H:C) ratios. Since asphaltene yields increase as operating temperatures increase, deasphalting is a severe service that requires rugged valve designs and engineered coatings.

The MOGAS C-Series full-ported valve design can be used in all asphaltene and deasphalted oil services with 100 percent reliability. In applications where heavy asphaltene build-up occurs, MOGAS offers an intermittent and continuous purge system to remove the asphaltene.



This midwestern refinery has four 20-inch ASME 300 class MOGAS ball valves in overhead vapor service. Several are in their second decade of service.



This 16-inch ASME Class 600 valve was installed for 550° F at 1095 psig (290° C at 75 bar g) lockhopper isolation service. Several of these valves withstood over 50,000 cycles.



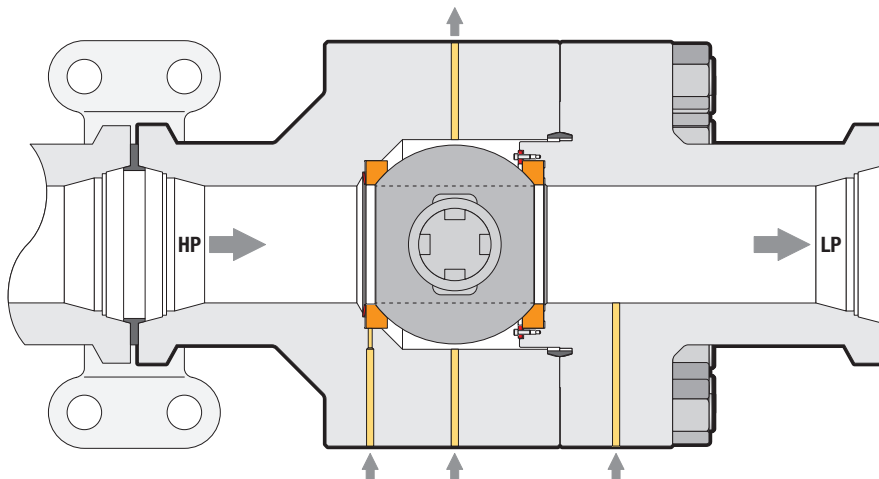
This large bore 24-inch metal seated ball valve was one of several chosen for a tar sands upgrade project. Ability to meet the stringent deadline was crucial to the success of the start-up.

Purge System

Alleviates Coke Build-up

Purging has been demonstrated to be effective in numerous field applications at minimizing the ill effects of coke formation. MOGAS highly recommends and offers purge systems designed specifically for valves in high-fouling applications to maximize the valve's operating service life.

MOGAS purge solutions have worked so reliably that some companies have incorporated it into their best practices design manual.



Purge locations shown are for illustration purposes only; actual purge locations will be determined based on application-specific data.

Purge Benefits

- Reduces operating torques from start of run to end of run in critical isolation valves
- Provides lubrication preventing excessive frictional forces on coating surface of ball and seats resulting in reduced repair costs
- Keeps coke build-up on ball in a soft condition allowing for optimal cleaning by scraper seats
- Proper sequencing allows for warm up avoiding temperature shock to control valves
- Allows isolation of redundant line for safe repair of instruments and control valves
- Eliminates coking in control valve station allowing for safe venting and draining of high pressure reactor effluent liquid and vapor

Industry Codes & Standards

The following partial list of industry codes and standards are referenced in the manufacturing of MOGAS valves: API, ASTM, ATEX, CRN, DIN, FCI, GOST-R, ISA, ISO, NACE, NBBI, PED, SIL, TA-Luft, TUV.

For a complete list, download our Design Conformance Standards from our Media Centre at www.mogas.com



Certificate No. 6593

ASME	Title
B16.5	Steel Pipe Flanges & Flanged Fittings
B16.10	Face to Face & End to End Dimensions of Valves
B16.11	Forged Fittings Socket Welding and Threaded
B16.25	Butt-welding Ends
B16.34	Valve – Flanged, Threaded & Welded End
FCI 70-2	Control Valve Seat Leakage

MSS	Title
SP-25	Standard Marking System for Valves, Flanges & Unions
SP-55	Quality Standard for Steel Castings for Valves, Flanges & Fittings
SP-61	Pressure Testing of Steel Valves

API	Title
598	Valve Inspection & Test
607 / 6A	Fire Test for Quarter Turn Valves
6D	Specification for Pipeline Valves

NACE	Title
MR-0103	Materials Resistant to Sulfide Stress Cracking in Corrosive Petroleum Refining Environments

British Standard	Title
BS 6755	Testing of Valves Part 1 – Specification for Production Pressure Testing Requirements Part 2 – Specification for Fire Type Testing Requirements

Service

Global Capabilities

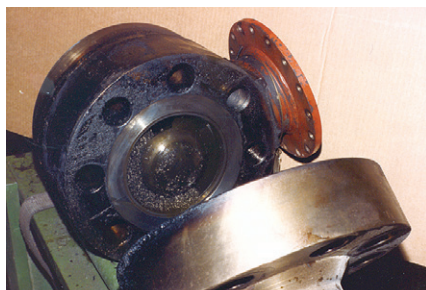


We provide exceptional service for unique locations—everyday, everywhere.

Service Excellence in Action

When you select MOGAS products, service is a big part of what comes with them. The MOGAS commitment to service means more than basic repairs. It also means timely access to our knowledgeable and experienced team of experts—anytime, anywhere in the world. And when our team becomes part of your team, you can trust that we will do everything we can to come through for you.

When you have a problem, our technical advisors get to the root of it. They will look at your entire application to accurately identify and solve the issue. Using a comprehensive approach helps you improve equipment reliability and operational efficiency, as well as reduce costs. Our core services include:



Catalyst particulates and harsh solids are easily handled by MOGAS valves. This valve was checked as part of a routine maintenance program and then was put back into service.

Project Support

- Installation, startup and commissioning
- Shutdown planning and implementation
- Procurement and contract management

Preventive Maintenance

- Complete system inspection
- Routine maintenance, valve repacking
- Valve asset management

Repair, Refurbish & Customization

- 24-hour emergency response
- Troubleshooting
- Valve performance analysis
- 3D finite analysis
- High pressure testing
- Online repair documentation

Asset Management Plan

Optimize Your Investment

Getting more **value** for every dollar is now more important than ever. To help **minimize your total cost of ownership** while truly benefiting from predictive maintenance, MOGAS offers the **MORE™ Asset Management Plan**—a totally customizable valve purchase and service plan. Whether you buy a few valves or several hundred valves, you can choose from a variety of options to help optimize your investment.

On-site Services

- Start-up and commissioning assistance
- Field support and troubleshooting
- Quarterly walkdowns
- Major shutdown planning

Managed Inventories

- Revolving dedicated inventory (located and managed at MOGAS facility)
- On-site inventory (for emergency use)

Walkdown Evaluations

- On-site inspection of installed valves
- Customized reports

Valve Management Program (Online)

- Initial setup, input, links to P&ID and maintenance reports
- Repair history
- Performance analysis reports
- Incident reports
- Valve repair cost
- Valve torques
- Revised bills of material
- Revised drawings
- Predictive / preventive maintenance recommendations

Certified Training

- Lunch-n-learns
- Valve installation & operation (hands-on)
- Maintenance & troubleshooting

Get **MORE™**...with **MOGAS®**

MANAGING OPERATION & REPAIR EXPENSES

- *Technical Assistance*
 - *Dependable Operation*
 - *Preventive Maintenance*
 - *Data Collection*
 - *Proactive Communications*
 - *Value Pricing*
-

Confidence for Tomorrow

A Warranty is Not a Performance Guarantee



CONFIDENCE

PREDICTABILITY

RISK FREE DECISIONS

IMPROVED SAFETY

ENHANCED RELIABILITY

LESS DOWNTIME

ANTICIPATED BUDGETS

Only from MOGAS

Continuous years of research and development, design innovation, advanced manufacturing techniques and field experience allow us to offer an application-specific PERFORMANCE GUARANTEE on our metal seated isolation and control valves...plus a lifetime warranty on materials and workmanship.

Severe Service

The MOGAS Definition

- Extreme temperatures
- High pressures
- Abrasive particulates
- Acidic products
- Heavy solids build-up
- Critical plant safety
- Large pressure differentials
- Velocity control
- Noise control

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